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THE
CONSTRUCTION AND MAINTENANCE
OF
SCHOOL INFIRMARIES AND SANATORIA.

7

PREPARED BY THE COUNCIL
OF THE
MEDICAL OFFICERS OF SCHOOLS ASSOCIATION,

And Published in Accordance with a Resolution passed at the Annual General Meeting of the Association, on April 26, 1888.

ALDER SMITH, } *Hon. Secs*
CHARLES SHELLY,

London:
J. & A. CHURCHILL, 11, NEW BURLINGTON STREET.
1888.

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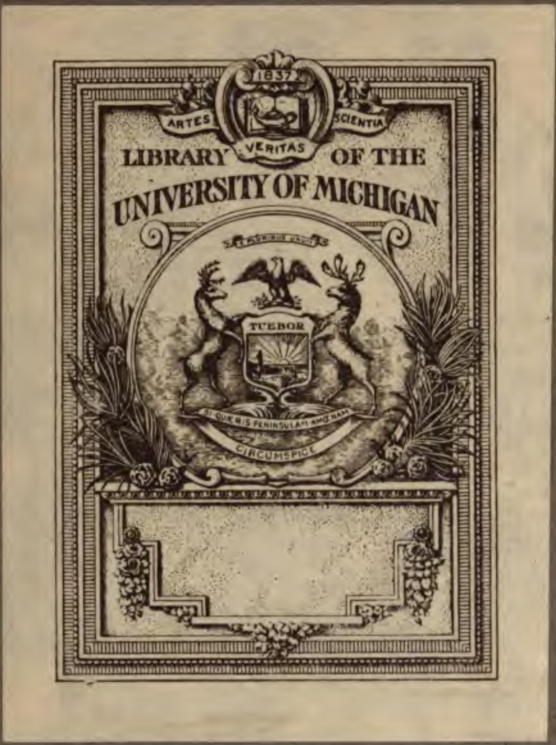

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PREFACE.

THE gratifying success which attended its issue of a "*Code of Rules for the Prevention of Infectious and Contagious Diseases in Schools,*" has encouraged the Medical Officers of Schools' Association to respond to the request, preferred by many members of the medical and scholastic professions, for definite recommendations in respect to the construction and maintenance of those portions of school buildings which are commonly set apart for the treatment of the sick and injured. It was urged that, as, from the sanitarian's point of view, the population of a school differs in many particulars from an equal number of the general community, so school hospitals must differ from ordinary hospitals; and that as the Medical Officers of schools might be trusted to have learnt what was required in this respect, so, also, they might indicate the direction in which their wants could be satisfactorily met. For, while the treatment of disease, both within and outside of schools, has been approximately formulated in the expression of combined experiences; the plans hitherto followed in constructing and managing those buildings devoted to the treatment of illnesses and accidents in schools are multifarious, at the least. In many cases such buildings are but slight modifications or imperfect adaptations of structures originally intended for some quite different purpose; and even where school hospitals have been specially built as such, they are mostly the several outcomes of individual minds, working independently, and often largely influenced and even hampered by special local considerations. The result is a variety of experiments, more or less successful; with but little evidence of any such common basis of operations as might be regarded as fitting and reasonable when dealing with the common and universal factors of school-life and school-sickness.

Under these circumstances it seemed possible, no less than desirable, to collate the results of various observers, and to note the points of general agreement; to indicate the main lines to be followed with the best advantage in the future; and to point out where modifications were either necessary or advisable in existing systems; to ascertain what was essential under any circumstances, and to note the special conditions in which certain deviations from the ordinary standard were permissible.

None but those who have attempted such a task can realise its difficulty. With the object of obtaining data to furnish a basis for calculation, information was sought from the authorities of a large number of public and private schools throughout the kingdom, and a very large number of replies were received in response to a paper which contained some fifty questions on points connected with the construction and management of school hospitals. Those returns which were so far detailed and complete as to admit of useful tabulation and comparison, were derived from thirty schools of various kinds and sizes. The number of pupils in each case ranged from 65 to 1,100, and the age of entrance from 3 to 18 years. Two of the schools contained less than 100 children each; ten contained between 100 and 200 scholars apiece; four contained between 200 to 300; four from 300 to 400; three from 400 to 500; four from 500 to 600; two from 600 to 700; and the number of children in one school exceeded 1,000. The total number of children contained in all the thirty schools under consideration amounted to nearly ten thousand.

Of these thirty schools no less than fourteen, or 46 per cent., are provided each with a single "Infirmary," in which *all* kinds of illness (infectious as well as non-infectious) are received and treated; seven of them are schools containing each from 300 to 1,000 pupils, and in none of these is definite provision made for the separate isolation of different kinds of infectious illness (with the single exception noted below*). Only nine of these fourteen schools possess "Observation Wards."

Fifteen out of the thirty schools, or 50 per cent., are provided with a 'Sanatorium' devoted to the treatment of infectious illness *only*, and eight of these fifteen schools possess in addition an 'Infirmary' for cases of accident and ordinary non-infectious illness *only*. Of the fifteen Sanatoria *twelve* are detached buildings; *six* possess each their own distinct laundries; *nine* have definite provision for the complete isolation of one set of cases from the rest; in *eight* the nurses in attendance on different kinds of illness can be effectually isolated from each other; in only *three* does provision exist for the treatment of school servants suffering from infectious illness. The accommodation provided in these fifteen Sanatoria ranges from a total of 4 beds (in a school of about 60 boys) to 68 beds (in a school of 500). In only *six* out of the fifteen cases is the existing accommodation for patients returned as "sufficient."

Of the whole thirty schools not more than *twelve*, or 40 per cent., are in possession of Disinfecting Chambers.

These excerpts from the Tabulated Returns may serve to indicate both the diversities which exist in practice, and the difficulties which attend any attempt to reconcile or to equalise them.

Schools differ greatly as regards their finances, their numbers, the ages of their pupils, and the social grades which they represent. Some occupy sites comparatively isolated, and possess an ample area for building purposes; others are crowded within or on the borders of large towns; while—even with respect to sanitation— customs, usages, tastes, and traditions exercise a force comparable only to their variety. Any endeavours to reconcile or to allow for all these differences in any single scheme would, obviously, be hopeless. It was, therefore, decided to attempt the description of such a School Hospital system as might be looked for in an *ideal* school:—in one, that is, able to devote a satisfactory site, ample ground space, and sufficient funds, to the efficient care of the sick and injured members of its community, unhampered by any considerations save those of health; and—since even the best schools must fall something short of the ideal—to point out, under the several sections of the subject, the limits within which special necessities would warrant some deviation from the ideal scheme with the least possible infraction of the laws of health. It is hoped that the resulting suggestions may thus come to serve as a work of reference to both the masters and the medical officers of schools, indicating, in this important branch of school hygiene, a standard neither needless nor impossible. That this standard should require subsequent modification in accordance with the lapse of time and the spread of hygienic knowledge is regarded as more than probable. It is put forward now with some confidence, as the result of many months of careful labour and anxious consideration; and in the belief that the criticism which it may be trusted to provoke can only result in a better understanding of the important subject with which it attempts to deal.

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* In one instance there is a separate building to which Scarlatina cases alone are relegated.

INTRODUCTORY.

A SCHOOL of any size requires special provision for the reception and treatment of the sick members of its community. This may be obtained by setting apart for that purpose certain rooms in the ordinary school building; or by providing one or more separate and detached buildings, to be used as Hospitals; and, by a combination of these two methods.

The patients who come under the care of the School Medical Officer are naturally divisible into four groups. They are persons—

(A) Affected by some form of NON-INFECTIOUS disease; or,

(B) Suffering from accident or injury; or,

(C) Those who are believed to have been exposed to the influence of some *Infectious Malady*, but in whom the disease (if contracted) has not yet developed characteristic symptoms; and,

(D) Those who are still actually suffering from one or other stage of an INFECTIOUS DISEASE.

Classes A and B may be conveniently treated together in one and the same building, and even in the same ward. But Classes C and D must receive accommodation quite apart from A and B, and quite distinct from each other. Moreover, it is necessary to make provision for the *separate* isolation (so long as may be necessary in each case) of such of the members of Class C as may have been severally exposed to different kinds of infection, and for such of Class D as may be actually suffering from different forms of Infectious Disease.

This necessity, admitted in the case of adults, is even more imperative in the case of children and young persons, since they are proportionately less protected by previous attacks of the several Infectious Diseases. Hence, broadly speaking, each School should possess—

1. Adequate accommodation for the reception and treatment of such of its inmates as may be suffering from ordinary *Non-Infectious* illness, or from the effects of accident and injury.

2. Separate accommodation for—

   (*a*) The temporary and separate isolation of those who have been *exposed to* any of the *several forms of Infection.*

   (*b*) The treatment of those actually suffering from *Infectious disease.* And in this latter case there should be provision for isolating and treating separately two or more different Infectious diseases, should these occur simultaneously.

The building, or that portion of a building, which is devoted to the treatment of ordinary non-infectious illness and of accidents only, is conveniently termed THE INFIRMARY: and the word will hereafter be used only with this signification. But in small schools, in which no further provision is made for the separate treatment of Infectious illness (*vide postea*, pp. 10, 29), two or more rooms or wards, at the top of the Infirmary, may be reserved exclusively for the reception of such cases (*vide* p. 10); these being known as the "Infectious Wards," or (perhaps better) the "Isolation Wards."

Where a separate building has been reserved solely for the reception of infectious cases, it has received various names, such as, the "Infectious Hospital," the "Fever Wards," the "Fever Block," &c. None of these terms is entirely satisfactory, and no really efficient word has yet been devised for the purpose. It is proposed here to speak of such a building as "The Sanatorium for Infectious Diseases" (or in briefer form as "The Sanatorium"). The phrase and the word are open to objection, but not more so than the other designations already mentioned, while they are, perhaps, somewhat less offensive. While it is not attempted to reconcile all traditions, or to override established usages, it is believed that only by the consistent and distinctive employment of two such terms as "Infirmary" and "Sanatorium," with a strict adherence to the meanings here assumed for them, will it be possible to avoid confusion and repetition otherwise inevitable.

Cases of ordinary non-infectious illness, and of accident, so frequently occur during school-life, that the necessity of some provision for their treatment is admitted on all hands. Details connected with the SCHOOL INFIRMARY will therefore first claim consideration. Moreover, the differences between the SANATORIUM and the INFIRMARY depend entirely upon the *kind* of illness to which they are severally appropriated; those points in which the construction and maintenance of the former contrast with that of the latter, are chiefly supplementary and additional, and their consideration may usefully be deferred until after the fundamental principles, common to them both, have received attention.

Section I.

THE INFIRMARY

is a building intended for the reception and treatment of cases of NON-INFECTIOUS ILLNESS and of ACCIDENT, *only*.

In every school cases of Infectious and of Non-Infectious disease are best treated in separate buildings. But in those small Schools in which such an arrangement is really impracticable, some other provision must be made for dealing with Infectious cases. This can be best effected by selecting two or more separate rooms, each large enough to contain two beds, and reserving them especially for this object. They are preferably situated in the building used for the Infirmary because, in the event of a sudden outbreak of Infectious illness in excess of the accommodation provided by these rooms, it may be possible to remove all the other (non-infectious) patients from the Infirmary, and to utilise the whole of that building as an Infectious Hospital for the time; and this can usually be done with a better chance of successful isolation of the infectious cases, than if another part of the School building were used for the purpose.

The rooms thus selected should be situated on the topmost floor of the building; they should not communicate with each other (in order that, should cases of different diseases occur simultaneously, they may be treated so far as possible quite independently of each other); and they should be continuously isolated, as far as practicable, from the rest of the building; thus, if access to these rooms can be obtained by a separate staircase, the door at the head of the main staircase should be closed and kept locked so long as infection exists. An additional room or rooms provided with a small kitchener and boiler, for the use of the special nurses in attendance; and a separate W.C. and lavatory, with a portable bath, all on the same floor or landing, will be most valuable adjuncts; but the additional expense entailed by specially providing these in any given case would probably be better and more economically devoted to the erection or adaptation of an entirely separate building ("SANATORIUM").

These "*Infectious*" or "*Isolation*" *Wards* should be dry, well lighted, and airy; each should possess an open fireplace; they, as well as all the other rooms on this floor, and the landing and staircase itself, should be thoroughly ventilated. Cubic space to the extent of 2,000 feet should be allowed to each patient in each room or ward. The furniture should be plain and substantial, and should comprise nothing beyond what is absolutely necessary; the floors should be carpetless; and the walls painted or distempered, rather than papered. It is desirable that one of the *Isolation Wards* should always be ready for use; and, during the winter months, it will be requisite to keep it warmed.* For fuller details *vide* Section II. "THE SANATORIUM," *postea*.

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* *Vide* "A Code of Rules for the Prevention of Infectious and Contagious Diseases in Schools," 2nd edition. J. and A. Churchill, vii. 4.

I.—SITE.

It is not necessary that the INFIRMARY should be a detached building, but it should not be in *direct communication* with any other part of the School premises. The chief points to be attended to are that—The building should be easily accessible from all parts of the School premises, while sufficiently removed from any particular region of noise or disturbance. It should receive its full share of fresh air and of sunlight. Its situation with respect to neighbouring buildings, and the height and arrangement of its own chimneys, should be so apportioned that it shall be free from the nuisances of smoke and down-draughts, and so as to permit of adequate provision for easy and effectual drainage. Grounds sufficient for the recreation and exercise of convalescent patients should be attached.

In cases where it is intended to construct a separate and detached building as an INFIRMARY, a dry, airy, accessible, and elevated site, and such as will allow the building to face S.E. and N.W., with a suitable fall for sewage, should be chosen.

2.—CONSTRUCTION.

The general plan of construction of the Infirmary, so far as it is influenced by the accommodation to be provided, must depend upon the size of the School, and the probabilities of its increase in numbers: *vide postea, "Accommodation" and "Internal Arrangement."* With respect to other details of construction, it must be remembered that the special modifications which are necessary in an Infectious Hospital are equally desirable wherever sick persons are collected within a confined area. So that within the limits suggested by such considerations the construction, arrangement, and fittings of an Infirmary may with advantage differ from the plans obtaining in the other School buildings. The advantages possessed by an Infirmary constructed upon such lines would become especially evident in the event of the building having to be used as a Hospital for Infectious cases only—as might be requisite in the case of a sudden and extensive outbreak of epidemic illness; and, even more frequently, in the not rare instances of those cases which, while under observation within ill-wards, develop the characteristic symptoms of an infectious disorder (e.g., Measles) that was only latent or barely suspected at the time of their admission.

(2) Foundations. “The foundations may be on the ordinary plan of buildings which have no basements, with a concrete layer, and a continuous and well-working damp-proof course.” But the building may with advantage be constructed on arches in excavated ground (Fig. 14, Plate iii.). “When this is done, then the ward level should be raised a step above the general ground level, so that there may be complete circulation of air around, above, and below the whole building. The arches should themselves be built upon a sound foundation of concrete, and the joists laid in a bed of concrete on the top of them; they should also be built sufficiently high to enable a man to keep the space beneath them clean, and free from rubbish collections.”*

In those cases in which space is limited, and its economy imperative, the Infirmary may be constructed with a basement in which the kitchen, scullery, servants' sitting-room, the hot-water apparatus, and the cellarage (but not the coal-cellar) may be located. In such a case the flue of the kitchen-fire and of the hot-water apparatus may rise as a central shaft in the Infirmary building, serving for the introduction of warmed air (drawn from outside above the level of the ground floor), and also acting as an extraction shaft in the withdrawal of foul air from the upper part of the building.

(3) Building Materials. “These may be of brick or stone as may be most convenient. The walls should be not less than fourteen inches thick, so that an equable temperature may be fairly maintained within the wards. The inner surface of the walls should be cemented, and coated with silica paint, in order that they may be readily and completely cleansed at all times, which could not be the case if the walls were papered.” Wainscoting is for the most part unsuited to the requirements of an Infirmary, and should not be used except,

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* The large extent to which the compilers of these suggestions are indebted to Mr. Charles Paget is indicated by the fact that of the numerous quotations to be found in the ensuing pages, all (with the exception only of those specially attributed to other sources) have been derived from his paper on “*The Arrangement and Construction of School Sanatoria*, lately published by the Association.

perhaps, in the case of the Dining Hall, and of the living and sitting-rooms on the ground-floor of the building. Rows of brackets for the support of metal picture-rods may be built into the tops of the walls at a convenient distance from the ceiling; pictures, &c., should not be suspended from nails, the driving of which into the walls is apt to break the surface, and so to afford irregularities which favour the lodgment of organic material, and which are difficult to keep clean or sightly.

(iii.) The Floor

The floors of the hall and passages on the ground-floor may be laid with a well-wearing stone or concrete, which can be covered if desirable. The highly-polished surface of well-laid tiles (unless covered) may give rise to accidents.

"The floors of the wards should be laid with well-seasoned wood, the boards being tongued and grooved," and so made as to fit as evenly and exactly as possible. With the best materials and workmanship, however, interstices between the floor-boards will exist, and their width will vary in accordance with constantly changing meteorological conditions : débris of all sorts is thus constantly being sifted through them, and accumulating beneath the floor; with the result that the space or packing between floor and ceiling becomes in time charged with slowly putrefying organic filth. The best and simplest plan for preventing such a result appears to be the following* :—The interstices between the floor-boards are firmly caulked—like a ship's deck—for about half their depth. Marine glue is then run into them, so as to fill them up level with the general surface. The adjacent edges of the floor-boards are thus connected by a waterproof and elastic cement.

Although a general polishing of the whole floor surface facilitates cleanliness, it is open to the serious objection of slipperiness. But the floor may be stained and varnished with good effect.†

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* Suggested by Dr. Thomas Fuller, of Lancing College.

† Dr. Langstaffe's Paraffin process has also been applied with satisfactory results,

(iv.) voidance of ght-angled corners.

"It is quite possible to scrape with a penknife from the floor in the corner of an ordinary room an amount of dirt which is often surprising. This, placed under a microscope, is ordinarily at least interesting; in the case of hospitals, the dirt may consist of epithelium, fine threads of lint, and other matters equally suitable for the retention of infection.

"The wards of any hospital should avoid the possibility of such a storage of contagium; and this may be done in a simple manner by replacing the right angles, made by walls with themselves and the ceiling and the floor," as well as the angles of all the door-panels and the sashes of window-frames, &c., "with quadrants, the concavities of which face the interior of the wards. The curves of the walls with the floor may be obtained by means of curved bricks, or by properly curved narrow skirting boards" (Figs. 1, 2, and 14; Plates I. and IX.).

(v.) Windows.

The windows should be "double-hung sliding sashes for purposes of ventilation, and should not be subdivided unnecessarily. They should be so spaced as to allow of the beds standing between and beneath them. They ought not to be more than three feet from the floor, and should rise to within six inches of the ceiling. An ample window area will be provided if there be one square foot to every seventy cubic feet of ward space; a greater amount of window area will be apt to unduly lower the temperature of a ward." Whenever the situation and arrangement of a ward will permit, the windows should be as much as possible on opposite sides, and directly facing each other. Ventilation will be facilitated by arranging the lower sashes to rise within a glazed 'hopper,' or by hinging them at their lower corners, so as to open inwards from above; by providing one or other form of "draughtless sash ventilation;" or, by dividing the window into three portions—the two lower being sliding sashes, and the upper one being hinged at its lower edge so as to open inwards from the top.

(vi.) Staircases.

The main staircase of the building may be of stone, wood, or iron, without elaborate ornamentation or scrollwork. It should be wide, and devoid of any sharp bends or angles, so that there may be no difficulty in easily carrying an ambulance from the bottom of the building to the top. It should be protected by a stout balustrade. The steps should be broad (not less than 12 inches) and shallow (not more than 6 to 6½ inches in depth), and without prominent nosings.

A secondary or back staircase, communicating only with the topmost floor (on which the *Isolation wards* are situated) will often prove of value in any case :—but in those smaller Schools which do not possess a Sanatorium for the reception of Infectious cases, and in which, therefore, Infectious illness when it does occur is treated in the special *Isolation wards* at the top of the Infirmary, a second staircase of this kind is essential to securing effective isolation (*vide* Infirmary, p. 10 *antea*, and Figs. 1, 2, 5, and 6; Plates I. and III.).

(vii.) Roofs a Ceilings

The roofs should be sloping and laid with slates or tiles, "but the inside ceiling must always be flat, to avoid projecting beams or the formation of ledges whereon infectious materials may be retained." The advantage of rendering fire-proof all timber-work, especially that used in the construction of roofs, floors, and ceilings, is obvious.

A large elevated skylight will serve to illuminate the upper floors and landings as well as the main staircase; and a couple of large exhaust cowls, one at either end of the skylight, will materially aid in the general ventilation of the building.

(viii.) Accommo tion.

The amount of Infirmary accommodation needed by any particular School is influenced to some extent by the average age of the scholars. Amongst young children the incidence of the various forms of infectious disease is more marked; while the rougher sports and the more individual life led by their seniors will be apt to determine a larger proportion of accidents and injuries, and to necessitate a longer period of treatment in accordance with their, usually, graver character. In any case it must be remembered that an excess of accommodation is an error on the safe and the right side, and one that may be a real advantage by supplying ample room for the indoor exercise and amusement of convalescents; while any approach to *over*-crowding in a building devoted to the treatment of illness and injury is certain to be in every way most prejudicial.

When the average age of the scholars does not exceed 12 years, beds to the extent of 5 *per cent.* of the *boarders* in the School should be provided in the Infirmary. When the average age stands at about 15 years, the allowance should not be less than 6 or 7 *per cent.*

In any School not provided with a Sanatorium, the above allowance should be reckoned *in addition to* the Isolation wards which are set apart, at the top of the Infirmary building, for the reception of Infectious cases. And, in all cases, the bed accommodation named is in addition to that required for the accommodation of the resident staff of the Infirmary (matron, nurses, servants). It is also necessary to provide additional and adequate accommodation for *Temporary Nurses* (*vide postea*, p. 26).

(ix).
General
rrangement
of the
Interior.

This will vary somewhat according to the size of the building, and other local circumstances. For a fairly large Infirmary —one containing from thirty to forty beds, for instance—the following general plan is satisfactory (*vide* Figs. 1 and 2; Plate I.).

The Ground Floor will comprise an Entrance Hall with two Entrances—arranged so as to be at right angles to one another—one communicating with the general School premises, and the other giving access to the Infirmary grounds: a small outer hall or lobby, if it can be provided, in which wet boots and coats, &c., can be removed, is advantageous.

Opening into the Hall will be :—

(1) The Matron's Sitting-room.

(2) The Dining Hall, which can, at other hours, be used as a sitting-room for convalescents.

(3) The Surgery, in which the medical officer can see those patients who are not confined to bed, and those who come up as "out patients."

It should be provided with at least one swing basin, supplied with both hot and cold water; and with shelves and cupboards to contain medical stores, instruments, &c. A dispensary can be provided in connection with the surgery.

(4) A small Waiting-room, furnished as a sitting-room and capable of being used as such when required.

(5) A Lavatory with a sufficient number of swing basins, furnished with hot and cold water supplies; a large sink similarly fitted, and (one or more) W.C.s.

(6) Kitchen and pantry.

Under certain circumstances (*vide antea*, p. 12) the kitchen and pantry as well as the larder, may be located in the basement of the building. It may also be possible to utilise part of the basement to form a dry underground play-room, which must be properly warmed, ventilated, and lighted.

The lift should be in direct communication with the kitchen (by means of an opening which can be closed when not in use, by a sliding glazed sash).

The First floor. The first-floor landing will surround a central rectangular space above the hall below, and protected by a proper balustrade. This opening, acting as a central shaft, aids in securing ventilation, and an equable diffusion of light and warmth throughout the building. At one end it will give on to the main staircase; the other end will afford room for a large linen press, which should be used for storing the bed-linen required for the rooms on this floor only.

Opening on to the landing will be the several wards; nurses' rooms, a bath-room, lavatory, and W.C.s; a lift chamber, properly protected and secured; the whole arranged according to one or other of the plans hereafter to be described in greater detail. A separate bath-room and W.C. may be provided for the use of the nurses.

Second floor. This corresponds in general plan with the first floor, with the following exceptions:—

An elevated glazed skylight in the roof stands over the central opening in the landing.

In the ceiling, at either end of the landing, is a *large* opening communicating with the two exhaust cowls: below each of these openings should be suspended a removable horizontal plate (with a superficial area equal to at least sixteen times that of the opening above it) which serves to distribute the 'exhaust draught,' which may otherwise be sometimes too direct.

That end of the landing which is remote from the main staircase is capable of being entirely cut off from the rest of the landing by means of doors which can be locked and a rising glazed sash, which can be raised when necessary (*vide* Fig. 2; Plate I.).

This secluded and separable portion of the landing will comprise two or more *Isolation Wards*, and a nurses' room; it communicates with the secondary staircase, over the head of which is fixed an exhaust cowl.

(x.) Special etails of Internal rrangement.

Kitchen Arrangements. It may sometimes be best that the bulk of the cooked food required for the Infirmary should be prepared in the School kitchens, and sent thence as needed at the usual meal-hours. In this case the food should be conveyed in a covered barrow, constructed on the plan of a Norwegian Kitchen.

But the Infirmary kitchen should be at least of such a size, and so furnished, as to allow of the ample preparation of soups, beef-tea, &c., for the maximum number of patients; in addition to cooking all food for the resident staff.

On each of the upper floors there should be a small gas-stove (with proper outlet for the products of combustion); this can be conveniently placed in connection with the bath-room. And, in connection with the Isolation wards, there should be a small kitchener or gas-stove, so that food may be prepared and warmed there for isolated patients without communication with any other part of the Infirmary.

Coals must not be stored in a cellar beneath the building, nor in the basement. They are best kept in an attached building communicating by a door or hatchway with the kitchen or the adjoining passage-way.

Hot water. The hot-water supply for baths, lavatories, &c., may be obtained either from a main boiler placed in the kitchen, or from a boiler-house if such is provided (*vide postea*, Warming, &c.)

Washing. The Infirmary washing will be sent to the School Laundry—with the exception of any linen, &c., used in connection with Infectious cases (should such occur amongst the Infirmary inmates); such infected linen should, after having been boiled, or steeped in disinfectants, be sent to the Sanatorium Laundry and to the Disinfecting Chamber, for thorough purification.

Refuse. No refuse of any sort should be permitted to accumulate upon the premises; the collection of each day should be removed within twenty-four hours, to be properly disposed of elsewhere.

Ambulance. A light stretcher (*e.g.*, after the St. John's Ambulance Association pattern) may be usefully kept in the main hall of the building. If suspended from hooks on the wall near a hot-water coil, it will be always dry and fit for use.

(xi.) Wards.

(*a*) *Size.* The wards should vary in size from rooms capable of accommodating two full-sized bedsteads upwards. In the larger wards the beds may be arranged along opposite walls, and alternating with one another; but the number in any one ward should not exceed eight or ten as a maximum.

(*b*) *Height of Wards and Bed Space.* The walls should never be less than 10 feet in height. Each bed should have 100 square feet of floor space allotted to it.* "The length and breadth of each ward must be so calculated as to allow of these spaces being evenly distributed amongst all the beds contained in it."

In arranging the beds of a ward it is desirable that each should be so placed as to stand out a clear 10 or 12 inches from the wall, so as to encourage the free circulation of air.

(*c*) *Furniture.* All the furniture of the wards and nurses' rooms should be strong, plain, and simple, and destitute of fluting and carving. The window blinds should be of a glossy material, dark blue in colour by preference.

"The bedsteads should be of iron, with a wire-wove spring mattress, and a single additional hair mattress, so as to permit of easy cleaning and disinfection."

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* In *large*, fully ventilated wards, with walls 12 to 14 feet in height, this allowance of floor-space might be slightly reduced.

No curtains, and no regular carpeting, should be used; but a rug or strip of carpet may be laid in front of the fireplace, before the washhandstand, and besides each bed. These must be removed and shaken at regular and frequent intervals. Should it be particularly desirable to avoid noise in a ward at any time, strips of felt druggeting may be pinned down to the floor in the lines of greatest traffic.

(xii.) rming and entilation.

(*a*) *Warming.* *The general warming* of the building is best accomplished by means of hot-water pipes,* of which a properly arranged coil should be placed in the hall, and upon each upper floor.

"The warming of small *wards* may be successfully accomplished by means of open fireplaces—especially if furnished with hot-air chambers; but for large wards—especially when there are beds on two opposite sides of the room—stoves open on two opposite sides and placed in the middle line of the room are more suitable." A small hot-water coil (the supply to which can be turned on and off at will) in each ward, will be found useful in airing mattresses, &c., and for keeping the wards dry.

Care must also be taken to secure the efficient warming o W.C.s and lavatories, as well as bath-rooms, by an extensio of the central hot-water system, if necessary.

(*b*) *Ventilation.* The *general ventilation* of the whole buildng will be aided by the central openings in each landing and in the hall, the two staircases, and the exhaust-cowls already mentioned.

In regard to *wards* and *sitting-rooms*, the stoves can be arranged so as to secure an influx of warmed fresh air during their use; and inlets can be provided by means of Tobin's tubes or brackets; by the use of a small hot-water coil in connection with the tube, the entering air may be warmed, and its rate of entry accelerated.

As regards *exit ventilation*, the natural action of open fireplaces may be aided in various ways; the various arrangements of valves opening into the upper part of the chimney are all more or less liable to be noisy in gusty weather, especially in the uppermost rooms of a building, and they occasionally fail to act. A better plan* is, to carry two plain shafts (of not less than 16 square inches, internal section) one on either side of the chimney-breast from within 6 inches of the ceiling to the level of the grate; at this point each shaft, by means of an iron elbon-pipe, bends on itself so as to open all but within the chimney-throat. The up-draught within the chimney will secure a down current in each of these shafts, thus exhausting the air of the room from its foulest uppermost layers, and discharging it into the chimney shaft; or similar shafts may usefully be built within the chimney-breast, during the erection of the building (*vide* Fig. 3; Plate II.).

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* *These should* always be so placed and arranged that they can be *ily kept clean* and free from dust, &c.

"When stoves are used, their chimneys may be carried through open funnels in the roof; and so, by warming the air in the funnels, aid its exit into the outer, cooler atmosphere;" at the same time lessening the risk of fire arising from an over-heated chimney shaft (*vide* Fig. 4; Plate II.).

(xiii.
Office

The closets must, under all circumstances, be cut off from direct communication with the wards and landing by a free cross-current of (sufficiently *warm*) air. They must also themselves be provided with a proper system of inlet and outlet ventilation, towards which the hot-water pipes employed for warming them, or a small special gas jet, burning in the lower part of an outlet shaft, may be specially arranged.

(xiv.)
Water su

The water supply will ordinarily be from the same source as that which supplies the whole School. The chief points to be observed are that the water suffers no contamination in the course of its transit to the Infirmary, or in its distribution throughout the building; and that within the Infirmary there should be two distinct systems of cisterns, one of which is alone used for the supply of lavatories, closets, and the like.

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* Recommended by Dr. Shelly.

When the Infirmary is provided with an independent water supply, whether derived from wells or otherwise, this should be in connection with a similar system of cisterns, so that the supply may be constant; "but no wells should be in use without being properly protected, thoroughly cleared out at least once a year, and the water from them regularly analysed" at frequent intervals, "so that the purity of the water may be insured as nearly as possible."

(xv.) ewerage. The sewerage arrangements of the Infirmary will usually correspond, and be in connection with, those of the general School system. But the junction must be protected by a proper and efficient disconnecting trap, and an air-break in connection with the several Infirmary ventilators and soil-pipes.

The rain-water pipes must have no direct connection with the drains; and there is no objection to collecting the rain-water in a suitably protected cistern, from which it may be pumped and used for washing purposes.

If the sewerage of the Infirmary be disposed of by means of the water carriage system, it is imperative that each soil-pipe be properly ventilated by carrying it up, full bore, above the eaves of the building from which it issues. "These ventilating pipes should act with the ground ventilator referred to, in keeping a constant current of air passing through the drains between all the W.C.s and the point of disconnection from the main drains or sewers. The entrance of sewer-gas into the Infirmary through the W.C.s will thus be prevented, as it will be carried away with the draught in the drains, and the drains themselves will be kept from becoming foul."

"All waste, sink, and rain-water pipes must be disconnected individually from the Infirmary drains in the ordinary ways as now generally understood, and as specially figured in the illustrated model by-laws of the Local Government Board* of this country."

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* Annotated Model By-Laws of the Local Government Board. Knight & Co., London, 1883.

The *Earth System* of sewage disposal will be required for the Infirmary only in those instances in which it is in force for the whole school. In any such case "the earth closet, on Moule's Patent, may be used safely in an Infirmary as the best means for disposing of the excreta, provided only that its essential points of management are properly and regularly attended to. The receptacles of the closets must be removed daily, * * * * by the man specially employed for the purpose, and the preparation of the earth for use in the closets must be one of his most constant cares. For this system to act successfully the earth must be perfectly deodorising, and for this purpose must be thoroughly well dried, and sufficient must be kept in stock to meet all demands.

"The place of deposit from the closets, and for the earth-preparation, must be as far from the Infirmary as may be; for, though the earth, when properly prepared, is inodorous, yet the processes in its preparation might occasion more noise than there should be in the neighbourhood of sick wards.

"The slop, sink, and waste-waters from the Infirmary should discharge in the open, near properly trapped gratings, and be drained on to land at some distance."

If a cesspool *must* exist, it should be placed no nearer to a dwelling-house than 50 yards; its ventilation must be secured by pipes of sufficient height, not less than four inches in diameter, and opening in a safe situation; it must be cemented inside and clay puddled outside; and it must be so large as to require emptying during the vacations only.[*] Special care must also be taken that the cesspool is so placed as to prevent the possibility of any source of drinking water in the neighbourhood becoming contaminated by its leakage, overflow, or otherwise.

Should there be any angles "in the lines of drainage, at such points alternate lamp-holes and man-holes must be placed in order that blocking of the drains may be at once discovered on examination, and remedied easily when found."

(xvi.) Gas-pipes

When the gas is first laid on, the pipes should be thoroughly tested in order to discover any leakage; and it is desirable to repeat this testing of the gas-pipes and fittings from time to time.

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[*] A Code of Rules for the Prevention of Infectious and Contagious Diseases in Schools. 2nd edition. J. & A. Churchill.

3.—ADMINISTRATION.

In all Schools, except those of the smallest size, the Infirmary will require regular and continuous supervision by at least one person resident within its walls.

(i.) ermanent Staff.

The *Matron* should live in the Infirmary building, for the general management of which she will be responsible, subject to the direction of the Medical Officer of the School.

(*a*) *Her Duties*. The duties of the Matron will comprise:—The management of the entire building, and of its daily economy; the general care of the patients, and their actual nursing (so far as may be permitted by her other duties); the effectual supervision of the nurses and servants of the establishment, as well as of the cooking, cleaning, &c.

She should keep a daily record of the In-Patients for the inspection of the Head Master and of the Medical Officer respectively. She is expected to maintain discipline amongst the inmates of the Infirmary, and she must report any case of serious illness or accident, and all instances of insubordination amongst either servants or patients to the proper authority without delay.

It is desirable that the Matron should be herself a duly trained and qualified Hospital Nurse. She will thus be not only better fitted to discharge the responsible duties devolving on her, but will also be the better able to maintain her authority and position whenever trained nurses are obtained for the special and temporary care of cases under her.

The Matron should be provided with a properly arranged book, containing copies of the answers given to the more important health questions on the entrance certificate of each pupil*; and she should keep this book written up to date by a reference to the certificates received at the beginning of each school term. Such information, if available, may often prove of value in the case of patients admitted with suspected infectious disease or after exposure to infection. Cases of this kind the Matron will at once send into the Isolation Wards, to await the opinion of the Medical Officer. The Matron should have nothing to do with any case of Infectious illness, should such be at any time under treatment in the (Isolation Wards of the) Infirmary.

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* *Vide* A Code of Rules for the Prevention and Treatment of Infectious Diseases in Schools, Appendix A: 2nd Edition. J. & A. Churchill.

(*b*) *Her Powers.* The powers of the Matron, as already indicated, extend to all details respecting the arrangement and management of the Infirmary and of its inmates, subject only to the direction of the Medical Officer and the Governing Body* of the School.

A printed notice embodying the more important regulations of the Infirmary should be prominently exhibited within the building.

(*c*) *Her Responsibilities.* In respect of her general management of the Infirmary as a part of the School, the Matron is directly responsible to the Governing Body.* In respect of all details connected with the management of the Infirmary as a Hospital, and with regard to her care of the patients, and her management of the details connected with their proper treatment, the Matron should be directly responsible to the Medical Officer, and through him to the Governing Body of the School.

The position of Matron of the Infirmary is—especially in large Schools—one of considerable difficulty, demanding good health, firmness, judgment, and tact, as well as experience for the adequate discharge of the responsible duties attaching to it. It is most important, in the interests of the School itself, that due provision be made for securing her comfort and maintaining her health; and care should be taken, and proper arrangements made, for ensuring to her outdoor exercise as well as proper rest.

(*d*) *Permanent Nurse.* In large Infirmaries the services of a *Permanent Nurse* are required, in addition to those of the Matron. Her duties will be under the control and direction of the Matron, subject to the directions of the Medical Officer.

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* Whatever its actual composition in different cases, the Governing Body is here taken to include the Head Master of the School.

The presence of a permanent nurse, accustomed to the daily routine of the Infirmary management, will be found of immense value in the event of the illness, or sudden removal from any other cause, of the Matron herself. Again, in the event of the development of a case of Infectious illness within the Infirmary, and of its treatment within that building (in the Isolation Wards), the Nurse can at once take charge of such a case, while the Matron continues to discharge her usual duties without the need for her being brought into contact with infection.

(e) *Servants.* The servants necessary to undertake the special cooking, cleaning, &c., required in a large Infirmary, can only do their work with advantage if living within the building. They will be under the direction and control of the Matron; who must see that they have regularly apportioned exercise.

Whenever the services of additional Nurses are required, the Medical Officer should be empowered to immediately procure such extra nurses as are needed. He will probably prefer to obtain them from one or other of the many institutions which exist for the supply of trained nurses. These nurses, so long as they are employed in the Infirmary, must conform to its rules. Like the other members of the staff, they will be under the control of the Matron, and responsible, through her, to the Medical Officer.

(a) *With the School.* Efficient means for ensuring prompt communication with the School—as represented by the Head-master, Steward, or Porter—should be provided; and it should be immediately available both by day and night. This can generally be effected by some form of speaking-tube, telephone, or other telegraphic instrument. The Matron should not be dependent upon Infirmary servants or convalescent patients for such a purpose.

(b) *With the Medical Officer.* The Matron of the Infirmary should also be able to communicate promptly with the Medical Officer of the School whenever the necessity for so doing may arise. If the Medical Officer reside on the School premises, one or other of the methods already mentioned may be used for this purpose: if he live at a distance, the Matron should be able to secure and employ a special messenger without delay.

(iv.) Cleaning

The whole *Infirmary building* should be thoroughly cleansed and aired from roof to basement during every vacation; at which period, also, necessary repairs will be carried out and defects made good. Paint, whitewash, &c., must be periodically renewed; and all apparatus connected with the water supply and warming systems, and the drainage arrangements, thoroughly overhauled.

The *Wards* must be kept well aired and dry when not in use; and the *Linen Stores* must also be examined at regular intervals.

The whole building should be aired, and (in the cold months) kept warmed throughout, for at least three days before the beginning of each term. An account of the necessary medical stores and appliances should be taken at the end of every term, and deficiencies should be made good before the beginning of the next term.

(v.) Protecti from Fi

Upon each floor of the Infirmary should be provided some simple and easily used means for checking the spread of fire—hose, hydrant, or some form of hand-grenade or extincteur: whatever the apparatus provided to this end, every member of the permanent staff should be thoroughly acquainted with the proper method of using it. The subject is alluded to here rather than under the head of "Construction," because any means of this sort—if it is to be ready for use at all times—must be made the object of regular care and frequent examination.

Section II.

THE SANATORIUM

FOR INFECTIOUS DISEASES is a building intended for the reception and treatment of cases of INFECTIOUS ILLNESS *only*.

"Provision by school authorities for the isolation and treatment of cases of infectious diseases in schools is only called for when the latter are of the nature of "boarding-schools.'

'Schools of this kind in England are generally known as 'Private,' 'Grammar," and "Public" schools, and on the Head-master or the Governing body of any of these falls the responsibility of protecting against the spread of infection from, and within, the schools. This responsibility is incurred on behalf of the public who may be unconnected with schools, quite as much as in respect of the boarders and their families, so readily may the infection of some diseases be conveyed for great distances and in the simplest of media. * * *

'Of all illnesses that may seriously affect the well-being of a school, quite apart from the dangers that may attend them, the chief are the infectious febrile disorders; and of these the most important and most liable to occur in epidemic form are scarlet fever, diphtheria, whooping-cough, measles, epidemic roseola, mumps, and chicken-pox. All of these, however mild the attacks may be, are apt to spread rapidly through a susceptible community, and seriously to interfere with school work. An outbreak of enteric fever may occur, and yet not be more mischievous in its effects on school-work than these more common ailments often are. For checking their spread special provision is undoubtedly necessary, and should be quite equal to average requirements."

The desirability of providing a *separate building* for the treatment of Infectious Disease was pointed out in the "Code of Rules," &c., first published by the Association in 1885. The advantage of providing adequate accommodation for this purpose in every school, however small, and the absolute necessity of doing so in a school of any considerable size, is being every day more generally acknowledged. It is only the very smallest schools which can afford to be content with "Isolation Wards," situated and arranged at the top of the INFIRMARY, as described, p. 10 *antea*. The precise limit of numbers at which the possession of a detached SANATORIUM becomes necessary to a school must remain, to some extent, a matter of opinion. But it may be laid down as a safe general rule that every school containing fifty or more boarders, should be provided with separate Sanatorium accommodation to some extent at least. But it should also be remembered that this necessity attaches with equal urgency to a school containing a much smaller number of boarders if it have, at the same time, a considerable proportion of "day-boys." To the smaller Grammar-schools, especially, does such a consideration apply. "In such schools the risks of introduction of infection are even greater than in the large public schools," because of the large proportion of day-boys attending them, and separate Sanatoria "are therefore desirable for the sake of the boarders, and for the repute of the schools as boarding-schools."

I.—SITE.

The SANATORIUM should be a *detached* building—completely isolated from school-buildings, playgrounds, infirmary, and dwelling-houses; and yet in the line of easy communication with the school.

"A country site—dry, airy, and elevated—should always be selected, with due regard to a suitable system of drainage. In a choice of sites that should be selected, other things being about equal, which gives the best fall for the Sanatorium sewage. If, however, it be impossible for a Sanatorium to be connected with a proper sewerage system, it will be necessary that some other means of sewage-disposal for the Sanatorium be adopted; and, in such circumstances, as this system must be entirely controlled and managed within the area of the Sanatorium site, it is essential that the area be not a confined one. Proximity to a manufactory or other trade-premises is most undesirable, for purity of air and absence of noise about any hospital is especially necessary."

The site should be enclosed by a good wall or fence at least six feet high.

"The Sanatorium ought not to occupy more than one-third of the area enclosed, so that there may be no overcrowding either of the buildings or of the patients in their convalescing stages. The limits of area may influence largely the form of building to be erected, but the rule is a sound one that there should be plenty of free air and ground space around a Sanatorium. The site had better seem to be too large than too small in area; and if it be larger than is at the first necessary, it will allow of additions being made to the Sanatorium buildings when these shall prove unequal to the wants of the school."

The Sanatorium should be so built that its "front and back aspects face respectively the S.E. and N.W., as in this way the best natural warmth and light may be secured, and direct exposure to the east wind may be avoided."

In laying out the grounds, the paths may be asphalted with advantage. Paths so prepared, if laid with a proper crown, do not absorb moisture, and dry quickly; they are thus better adapted than gravel for affording exercise to convalescents.

"A good Sanatorium site is almost impossible in a large town, and the most that can be done for the school" so situated "is to fit up rooms specially as a Sanatorium at the top of some building, separated from all other builings in daily use by the healthy boys of the school."

II.—CONSTRUCTION.

The essential details of Construction, as described under Section I., INFIRMARY, *antea*, apply equally in the case of the SANATORIUM. But in the latter case it is, if possible, even more imperative to favour absolute cleanliness by securing smooth, unbroken, and polished surfaces for floors, walls, and ceilings; by abolishing right-angled corners; and by providing efficient ventilation.

There must be some efficient means for effectually isolating one set of Infectious cases (together with the Nursing staff in attendance on them) from other patients suffering from a different Infectious malady. In other words, the SANATORIUM wards must practically be in at least two sets, so arranged that they can be completely cut off from all communication with each other.

As the Sanatorium should not draw its supplies of food directly from the School-kitchen, and as it should possess its own laundry and a Disinfecting Chamber, a special arrangement of Administrative Buildings and Offices is required.

Masters and other resident Officials of the School, together with any members of their families suffering from Infectious Disease, are preferably treated in the Sanatorium, and proper accommodation may be made for this purpose.

In large Schools, at all events, some accommodation for treating School-servants suffering from Infectious illness should be provided.

The absolute amount of accommodation to be provided for patients, and the relative importance to be allotted to each of the several objects just reviewed, will depend, in any given case, chiefly upon two considerations—viz., the size of the school, and the average age of the pupils at entrance. But it is always desirable that a Sanatorium be so designed that, in the event of increased accommodation becoming necessary, its extension may be carried out without cramping or obstructing the buildings already in existence.

(i.) Foundation.
(ii.) Building Materials.
(iii.) Floors.
(iv.) Avoidance of right-angled Corners.
(v.) Windows.

Vide antea, Section I. THE INFIRMARY, pp. 12—14.

(vi.) Staircases

For materials and other details of construction, *vide antea*, p. 14. But the necessity for two staircases is *absolute* in the case of the SANATORIUM, unless the building is constructed so as either (*a*) to allow of all the wards being arranged in two distinct sets upon the ground-floor; or (*b*) so as to provide one set of wards on the ground-floor and another set on the first-floor, as in Figs. 15 and 16, Plate X.

If the SANATORIUM be built in three floors, it will be best to have no beds on the ground-floor, and it is then necessary to provide a second staircase, which should be sufficiently capacious to serve the wards on the second, or on an isolated part of the second, floor. In some instances it may be necessary or desirable to provide one or more light spiral staircases for the special use of the nurses in attendance (*vide* Figs. 9—13, Plates V.—IX.).

(vii.) Roofs an Ceilings.

Roofs should be sloping, and may be slated or tiled. The inside ceilings should be flat, without beams, cornices, or ledges; and painted rather than white-washed, as the surface is smoother, and there is less risk of cracking in the former case.

All timber used in the construction of the building should be fire-proofed. (See also p. 15, *antea.*)

(viii.) ccommodation.

The question as to the amount of Sanatorium accommodation (or the "number of beds") which should be provided in any particular school, is of the utmost importance. On the one hand, it is obvious that no real advantage accrues from a needless and excessive allowance, which is extravagant in the first instance, and expensive to maintain; too apt, therefore, to become neglected; and in consequence comparatively useless (or even worse) when it is most urgently required. On the other hand, it must be remembered that, unless the Sanatorium accommodation provided is at least equal to meeting the *probable* extent of a full outbreak of epidemic disease (and two or more epidemics of different kinds may be concurrent), the Sanatorium at once ceases to be reasonably efficient as regards the protection which it should afford to the school; while the temptation to overcrowding under such circumstances may wantonly jeopardise the recovery of patients treated within its walls.

Every school, however, can furnish certain important *data,* the careful consideration of which will materially aid in solving the question as to its own requirements in this respect. These *data* are supplied by—

(*a*). *The average age at entrance* of the pupils of the school. As regards those febrile diseases one attack of which usually serves to protect the individual against a second, the liability to infection decreases very rapidly with advancing years up to the age of about 17 or 18. For most of these diseases a fairly definite line may be drawn at the age of from 12 to 13; and, while of young children—aged about 8 to 11—not less than 50 *per cent.* are usually *unprotected* by a previous attack of measles, for example, the proportion falls to about 25 per cent. for school-children between the ages of 13 and 14 years; while by the age of 17 years all save about 7 per cent. will ave already had the disease, and may, therefore, be considered as now protected against it.*

At the present time, for large boarding schools in which the average entrance-age lies between 13 and 14 years, the proportion of boys *unprotected* by a previous attack of the commoner epidemic diseases appears to be as follows :—

70—80 *per cent.*	are	*Unprotected*	by a previous attack of	SCARLET FEVER.
25–29 *per cent.*	,,	*Unprotected*	,, ,, ,,	MEASLES.
About 25 *per cent.*	,,	*Unprotected*	,, ,, ,,	GERMAN MEASLES.
50—70 *per cent.*	,,	*Unprotected*	,, ,, ,,	MUMPS.
25—30 *per cent.*	,,	*Unprotected*	,, ,, ,,	WHOOPING COUGH.

An examination of such statistics for the last quarter of a century would, however, seem to demonstrate (owing doubtless to the wider spread of hygienic knowledge, and the greater care consequently exercised in the recognition and isolation of first cases in families and during infancy) that fewer children are nowadays attacked by these maladies in the earlier years of life; and that, as a necessary result, the proportion of children *unprotected* against epidemic disease at the time of their beginning life at boarding schools will continue gradually to increase, as it has been increasing of late years. Such considerations make it improbable that the need of efficient Sanatorium accommodation will be less in the future than is now the case.

(*b*). *The existence or otherwise of the 'House-System'* in a school exerts a material influence upon the incidence of epidemic illness. Although all the boys must mingle with each other to a large extent, in virtue of school-work and school-play, yet each separate Master's 'House' is, within certain limits, a distinct and partially isolated section of the community. Such a splitting up of the whole will sometimes make it more easy to check and stamp out an incipient epidemic. And, even with diseases, *e.g.* Measles, where "stamping-out" seems practically impossible, the 'House-System' certainly appears to *delay* the progress of the epidemic, protracting the time of its incidence, and by so much lessening the number of patients who need to be under treatment at one time. Probably, in a large school (say of over 250 boys), with the age at entrance averaging 13½ years, the existence of the House-System may be taken to lessen the amount of Sanatorium accommodation required, by a number of beds equal to from three to four *per cent.* of the boarders.

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* A second attack of true Measles in the same individual is *extremely* are before puberty.

Some schools conducted on the House-system possess no INFIRMARY: cases of ordinary non-infectious illness being treated in the "Sick-rooms" provided in each Master's House. When such an arrangement obtains it must be remembered that the absence of a distinct Infirmary building (which might, in case of necessity, be utilised for the isolation and treatment of Infectious cases, vide INFIRMARY, *antea*, p. 11) greatly emphasises the necessity for full and sufficient accommodation for the proper treatment of epidemic illness in the SANATORIUM.

(*c*). *Day Boys.* A school comprising a considerable proportion of day-scholars is liable to the more ready, and practically therefore to the more frequent, introduction of infection. In other words, in such a school, epidemics of infectious illness are apt to recur at short intervals; consequently susceptible members of the community are liable to be attacked comparatively soon after entering the school; and they therefore come under treatment in comparatively small batches—because the *unprotected* individuals rarely accumulate to any considerable total before they are exposed to repeated opportunities of infection.

It will probably be safe to consider that in such schools the amount of Sanatorium accommodation required will be less than that needed if no day boys attended, by a number of beds equal to at least 2 *per cent.* of the total number of boarders in the school.

(*d*). *Division into Junior and Senior Schools.* Whenever a large school is distinctly divided into a Junior and a Senior establishment, the latter is thereby greatly protected against the incidence of epidemic disease; a most weighty consideration with regard to the serious influence which an extensive outbreak of infectious illness always exerts upon the more important scholastic work of the older pupils. The lower, or Junior, school is prone to suffer from frequent and extensive epidemics, in virtue of the large amount of susceptible material which is constantly being collected within its walls; but the Upper or Senior school, being recruited by those who have, for the most part, been already protected by a previous attack during their life as Junior pupils, is apt to escape epidemics for long periods together; and the extent of such outbreaks is comparatively insignificant when they do occur.

From the point of view now under consideration, it would appear that the best age for boys to leave the Junior and enter the Senior school is about 12 to 13 years. Under such circumstances—the Senior and Junior schools being conducted as distinct establishments—it is obvious that there will be a very great disproportion as regards the amount of Sanatorium accommodation severally needed in the two cases.

(*e*). *The Periodic Recurrence and the Extent of Epidemics in Schools.* It appears that whenever the total number of susceptible individuals reaches a certain proportion (varying with each disease) of the whole community, an outbreak of epidemic illness becomes imminent. It is, at present, difficult to state this ratio precisely for many diseases; and with respect to some—scarlatina, *e.g.*—the Doctrine of Probabilities may often be successfully defied by the prompt and effectual isolation of first cases. For *Measles,* however, it may be stated that—in large schools comprising boarders only, with an entrance-age averaging 13½ years; and neglecting small and abortive outbreaks beginning late in the term, for instance—whenever the total of individuals *unprotected* by a previous attack has risen to from one-fourth to one-third of the whole number of pupils, an outbreak of the disease may be looked for with some confidence; and in such an outbreak (if it have full scope by beginning early in the term), about three-sevenths of the *unprotected* (*i.e.* one-seventh or 14 per cent. of the total number in the school) will be attacked.

In the case of young children (*e.g.*, schools with an entrance-age *circ.* 8 to 10), the proportion attacked is much larger, equalling about 70 *per cent.* of the *unprotected.*

Epidemics of *Rötheln* occur on much the same lines as those of Measles.

(*f*). *Influence of Health-Certificates.* The above considerations must be taken as especially applying to schools in which is rigidly enforced some system of Health Certificates such as those suggested in Appendix A of the "Code" published by the Association.

Schools whose regulations are lax in this respect, lay themselves open to frequent incursions of infectious illness; and, in such schools, epidemics, while they will occur more frequently, may often be of comparatively small dimensions, for reasons similar to those which apply to mixed communities of day-scholars and boarders.

(*g*). *Social Status of the School.* This may exert an important influence on the liability of young pupils to infectious illness. Amongst the poorer classes, *young* children are more frequently exposed to infection, and the isolation of the infected is much neglected. Such children consequently enter school already protected by previous attacks of the commoner epidemic diseases, in a proportion much above that obtaining in the schools of the better-to-do and more affluent classes, whose children are carefully guarded from infection during the pre-scholastic age. Attendance at a large preparatory school before entering at the boarding school will, to some extent, modify this condition.*

(*h*). *Servants.* A school (unless it can always command the advantage of access to some public institution for the reception of infectious patients) should—for its own protection—provide for the treatment of such of its resident staff of servants as may from time to time be attacked by epidemic disease.

Such patients should be treated in the SANATORIUM, but apart from the pupils of the school.

The amount of special accommodation required to this end will not be large, especially if the servants employed are adults. Probably the provision of two to three beds for this purpose will suffice even in the case of the largest schools.

Conclusions. It will be obvious that boarding-schools are very variously circumstanced as regards the precise amount of Sanatorium accommodation which ought to be provided in each case. But taking as a common example a large boarding-school containing 300 or more boys; with an entrance age of between 12 and 14; the average age of leaving school being about 18; it may be stated that—*in order to provide proper accommodation for treating full outbreaks of Epidemic illness, and allowing for two or more Infectious Diseases being Epidemic in the school at the same time*—the number of beds available in the Sanatorium should equal 20 *per cent.* of the total number of boarders. This allowance does not include the provision needed for servants (*q.v. supra*).

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* The conclusions advanced in the preceding paragraphs are based on statistics compiled by Dr. Shelly, of Haileybury College, and were laid by him before the Association in a paper on "*The Liability to Infection during School-Life, and its relationship to Sanatorium Accommodation.*"

It is not necessary that the whole of this accommodation should be provided in a building constructed in the same permanent and substantial manner throughout. From one-third to one-half of the amount named may fairly be of a semi-temporary character, consisting of a semi-detached *annexe* built of wood with double walls; or of corrugated iron, lined with match-boarding; or constructed after the manner of portable "Camp-houses." The initial cost of construction, and the expenses of maintenance would thus be considerably reduced without any impairment of efficiency. During the lesser outbreaks, the large empty ward of this annexe would serve admirably as a play-room for convalescents, and would thus add materially to the health value of the Sanatorium. (*Vide* Play-room, *post.* p. 39.)

Special circumstances may justify a considerable reduction of the total accommodation named above; thus—

Those who consider it unwise or unpractical to provide accommodation in the SANATORIUM for an epidemic of *Measles*, may, for this reason, reduce the number of Sanatorium beds from 20 *per cent.* to 10 *per cent.* of the total number of boarders in the school. Under such circumstances, should an extensive outbreak of Measles or of Rötheln occur in the school, it will probably be necessary to use some other school building, class-rooms or dormitories, &c., as an Infectious Hospital for the time. Such a measure involves considerable interference with the regular school routine, and the rigid isolation of the infected is well-nigh impossible in such a case.

The existence of the "House System"—the several Masters' houses being quite distinct and isolated—may justify a total of 16 *per cent.* only, instead of 20 *per cent.*

The presence of *a considerable proportion of Day Boys* in the school would justify a similar reduction of 2 *per cent.*

The co-existence of *a distinct and separate Junior school,* from which the Upper or Senior school is recruited, will reduce the total Sanatorium accommodation needed by the latter to about one-third of the amount otherwise required.

Similarly, *raising the average Entrance-age* from 13·5 to 15 or 15·5 years will reduce the standard of accommodation required by about one-half.

As with the Infirmary, the bed accommodation named in the above instances is additional to that required for the Sanatorium staff (Matron, Nurses, Servants); nor, as already stated, does it include the beds to be provided for school-servants suffering from infectious illness.

(ix.) General Arrangement of the Interior.

This will vary immensely in detail, in accordance with the size of the Sanatorium under consideration, from a small isolated cottage upwards. The smallest Sanatoria (*e.g.* a single cottage) are best arranged after the method advocated in the case of small Infirmaries (*vide antea,* p. 10), so as to provide on the top floor two or more rooms which can be cut off from communication with the rest of the house. Different plans for larger buildings will be found briefly described later on (*vide* Plates III.—XIII.)

In the main, the arrangements (both general and particular) of the Sanatorium will correspond with those advocated for the Infirmary (*vide antea,* pp. 16 *et seq.*); the chief exceptions being noted below:—

Staircases. The staircases *must* be so arranged as to permit of one, isolated, part of the building being reached without any communication with the occupants of the other part of the Sanatorium.

Kitchen. The kitchens should be large enough, and the arrangements such as to allow of all the food required in the Sanatorium being cooked in them.

Laundry. The Sanatorium should have its own laundry, and one fully capable of dealing with all the washing required.

It should also have an efficient Disinfecting apparatus, large enough to take a full-sized mattress.*

Wards: Bed-Space. "Each bed," intended for an adult, "should have 144 square feet of floor space allotted to it."† Carpets and rugs (as being liable to harbour infection) are not permissible in the Wards of a Sanatorium. "A thin, glazed drugget may be pinned down on the floor when it is particularly desirable to avoid noise in the Wards."

Playroom. It is of the greatest advantage to provide a large room, or at least an enclosed, dry, and well-lighted space, which can be properly warmed and ventilated, for the recreation of convalescent patients. This room should be in addition to the "Sitting-rooms" provided; and it will be needed as a sick-ward only in the event of the larger outbreaks. It should be properly warmed, but the less furniture it contains the better. If the windows are protected by light hanging curtains of galvanized wire-netting, a modified form of tennis or cricket may be permitted, without risk of damage being done. It is impossible to over-estimate the value of such active occupations in the case of otherwise isolated convalescents, whether from the moral, mental, or physical point of view.

Ambulance. The Ambulance "may be a one-horse vehicle; or, if the Sanatorium be not very far from the school, and the approach to it a private one, a light covered stretcher-bed that could be easily carried with a patient on it by two men might be used."

It is conveniently kept under cover in an out-house connected with the administrative building. Care must be taken that it is always dry, aired, and fit for use. After it has been used for the conveyance of an infected patient, it must be disinfected before it is again returned to the place in which it is usually kept.

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* Full details respecting the best method of securing Disinfection by heat will be found in the report of Dr. Parsons to the Local Government Board for 1884. (Parliamentary Paper No. C—4,516 of Session 1885.)

† *Vide* Tenth Annual Report of the Local Government Board 1880-81. Supplement on the Use and Influence of Hospitals for Infectious Disease [C—3,290] 1882, p. 14. Also, ". . . . in no case should the ward-space for a child in an Infectious Hospital be less than three-fourths of that which is deemed necessary for an adult." (*Ibid.* p. 15.)

III.—ADMINISTRATION.

aretaker. Every Sanatorium, however small, should have a person in charge of it, and continuously resident within its walls, so that it may be kept aired and habitable, and ready for use whenever needed.

Matron. A large Sanatorium will also require the services of a *Resident Matron*. Her duties, responsibilities, and privileges will correspond, *mutatis mutandis*, with those of the Matron of the Infirmary (*q. v. antea*, p. 24). But she is to be regarded as an independent official, responsible only to the Medical Officer and to the Governing Body of the School, in the same way as is the Matron of the Infirmary.*

She should be provided with a properly arranged book, in which she will keep a daily record of all patients received into the Sanatorium, noting the date of admission, the nature of the disease, and the date of discharge in each case.

As the SANATORIUM may be unoccupied for months together, it may be convenient to arrange that at such times, and with the sanction of the Medical Officer, the Matron of the Sanatorium shall share in the duties of the Infirmary, relieving the Matron of the latter for a certain number of hours in the morning or in the afternoon, as may be most convenient. In large schools, such a temporary division of labour, when practicable, is of service to all concerned. Of course, directly a patient is admitted into the Sanatorium, all such communication with the Infirmary and the School must at once and absolutely cease.

Servants. A married man and his wife, the latter of whom should be a good cook, form the most useful staff of permanent servants for a large Sanatorium. Where extra housework is caused by the admission of a large number of patients, additional servants must be obtained for the time being. They should not be too young, so as to lessen the risks of their contracting infection. Proper accommodation should exist for their residence within the Sanatorium for so long as their services may be required, and they should not allowed to leave the building without first undergoing rough disinfection of person and of clothing.

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* Whatever its actual composition in different cases, the Governing Body is here taken to include the Head Master of the School.

Tempor and additio Nurses

These will be obtained whenever their services are condered necessary by the Medical Officer. Their position the SANATORIUM will correspond to that of the Nurses mporarily employed in the Infirmary (*q. v. antea*, p. 26); e necessity for their proper accommodation within the uilding, and for their efficient disinfection on leaving it pplies equally as in the case of the temporary servants mentioned above.

Means Commun tion with School with th Medica Officer

This is especially necessary in the case of the SANATORIUM, on account of its isolated position.

Communication with the School should be made by means of some form of telegraph or telephone. Messengers must not be employed for this purpose, as *there should be no direct personal communication* between the Sanatorium (when occupied as an Infectious Hospital) and the School.

Communication with the Medical Officer may be either direct, by means of some form of telegraphic apparatus, if the Medical Officer reside close at hand; or indirect, through the telegraphic apparatus connecting the Sanatorium with the school, as above.

Cleani

The Sanatorium building needs regular and periodical cleansing, airing, and repairing, &c., equally with the Infirmary (*q. v. antea*, p. 27).

One ward and a couple of beds should be kept always warmed and ready for use throughout the term.

Pr fr

The measures advocated in the case of the Infirmary (*vide antea*, p. 27) apply with still greater force to the more isolated Sanatorium.

The Sanatorium building ought to be provided with a large Fire-bell, which can be rung to summon assistance in the case of an outbreak of fire, or in the event of other serious and sudden accident.

SKETCH PLANS FOR SCHOOL

INFIRMARIES AND SANATORIA, &c.

It is not pretended that the accompanying plans include everything that might be designed in the way of efficient buildings for School Hospitals; but they may well serve to illustrate most of those details in special construction and arrangement which have been advocated in the foregoing pages. Moreover, each is capable of considerable modification in accordance with the requirements of any particular case without sacrificing the principle of its design. Thus, Wards for servants, and a Laundry, might be added to each of the buildings planned on Plate X. and on Plates XI.—XIII., after the manner indicated on Plates III. and IV., Figs. 5—8; and Figs. 5 and 6, Plate III., would also serve as the design for a small Infirmary, with *Isolation Wards* for infectious diseases, as described on p. 10.

The general plans of arrangement sketched on Plate VIII. and on Plates XI.—XIII. have manifest advantages wherever the necessary space is available for building such an Infectious Hospital.

Figs. 5—14 are copied (with a few slight alterations), by the author's permission, from the plans printed and described in Mr. Charles E. Paget's paper on "*The Arrangement and Construction of School Sanatoria,*" lately published by the Association. To Dr. Clement Dukes, of Rugby, the Association is indebted for Plates XI., XII., XIII., which are copied, with one slight modification, from the plans of a model school Sanatorium, recently published by him in "*Health at School,*" to which work reference may be made for fuller details; and Mr. Keith D. Young, F.R.I.B.A., has kindly sanctioned the use of Figs. 15 and 16 on Plate X. To each of these gentlemen the Association would express its sincere appreciation of their courteous help.

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Wherever these bracketed letters do not appear, the references are meant to apply to both Infirmary and Sanatorium.

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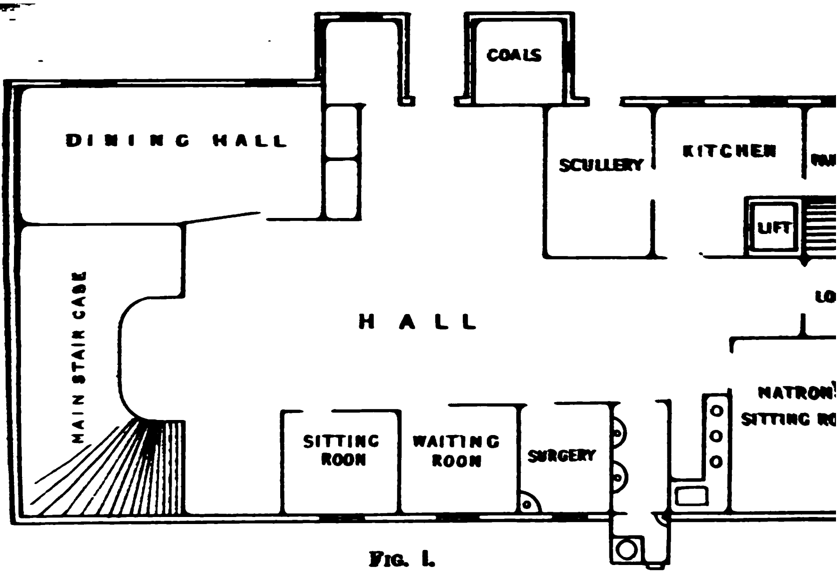


FIG. 1.

GROUND PLAN OF AN INFIRMARY BUILDING.

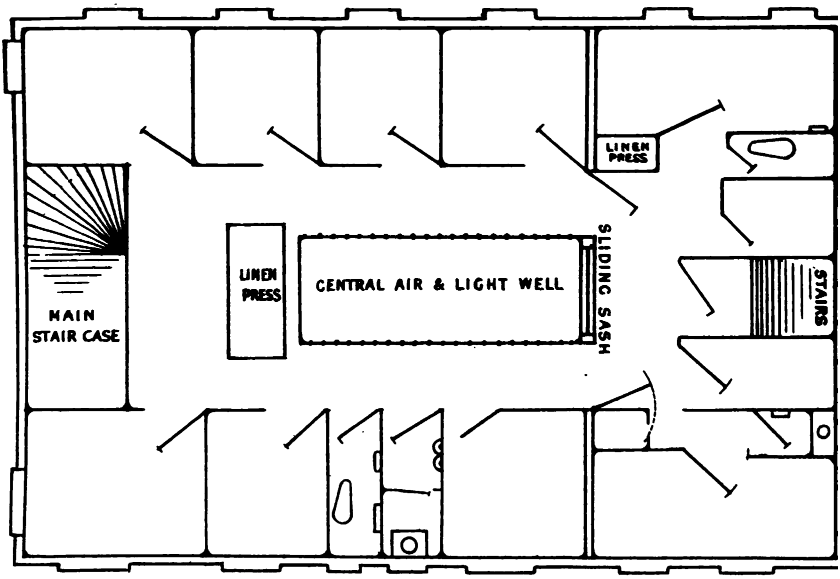


FIG. 2.

TOPMOST FLOOR OF INFIRMARY BUILDING.

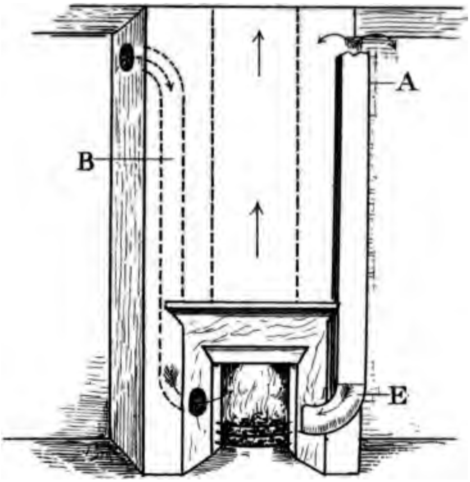


Fig. 3.

ENTILATION OF ROOM BY MEANS OF VERTICAL SHAFTS OPENING INTO CHIMNEY THRO

HAFT FITTED EXTERNALLY. B. SHAFT BUILT IN CHIMNEY-BREAST.

E. IRON ELBOW PIPE.

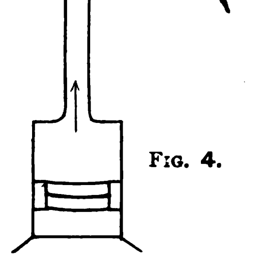


Fig. 4.

XIT VENTILATION BY MEANS OF STOVE PIPE PASSING THROUGH OPEN FUNNEL.

Plate II.

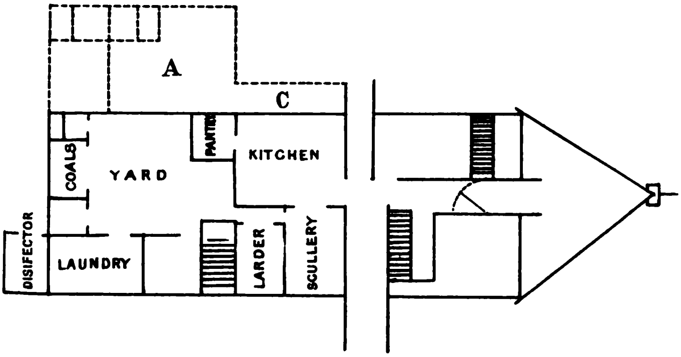


FIG. 5. GROUND FLOOR.

A. ANNEXE.—PLAY-ROOM (OR WARD) C. COVERED WAY.

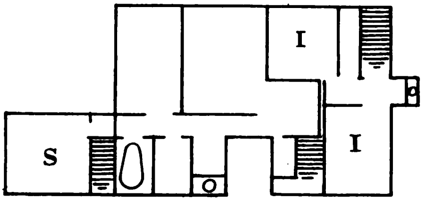


FIG. 6. FIRST FLOOR.

ANATORIUM INCULDING ADMINISTRATIVE BUILDINGS; ANNEXE; SEPARATE STAIRCASE TO TWO ISOLATED WARDS (I.I.) ON FIRST FLOOR; AND SERVANTS' WARD (S.)

THIS DESIGN WOULD ALSO SERVE FOR A SMALL INFIRMARY.

ADAPTED FROM PLAN E, PAGET'S "SCHOOL SANATORIA."

Plate III.

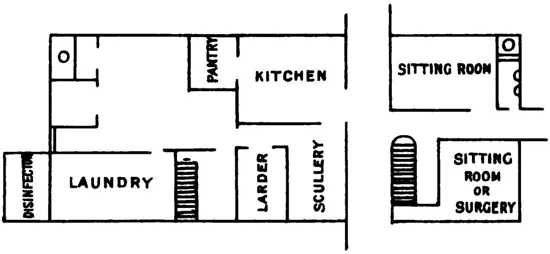


FIG. 7.

ADMINISTRATIVE BUILDING (GROUND FLOOR) FOR SANATORIUM.

AFTER PAGET'S "SCHOOL SANATORIA." PLAN E.

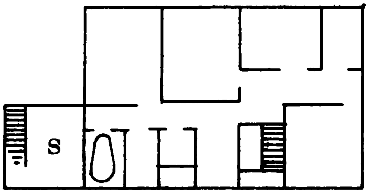


FIG. 8.

FIRST FLOOR OF ADMINISTRATIVE BUILDING (AS ABOVE FIG. 7.)

S. SERVANTS' WARD.

Plate IV.

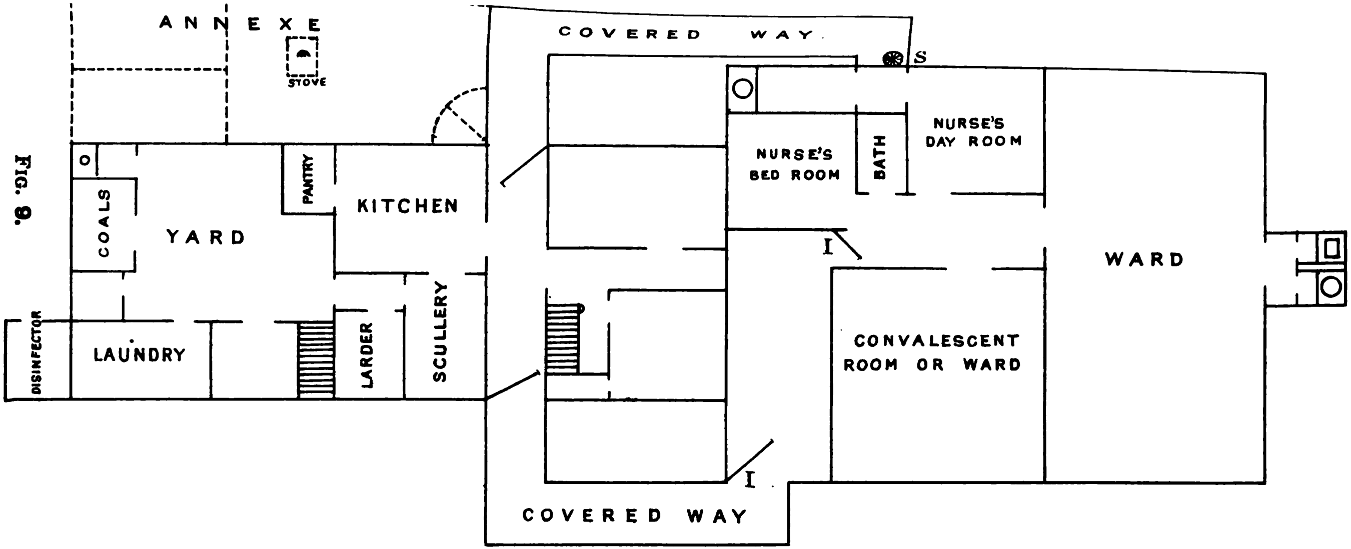


Fig. 9.

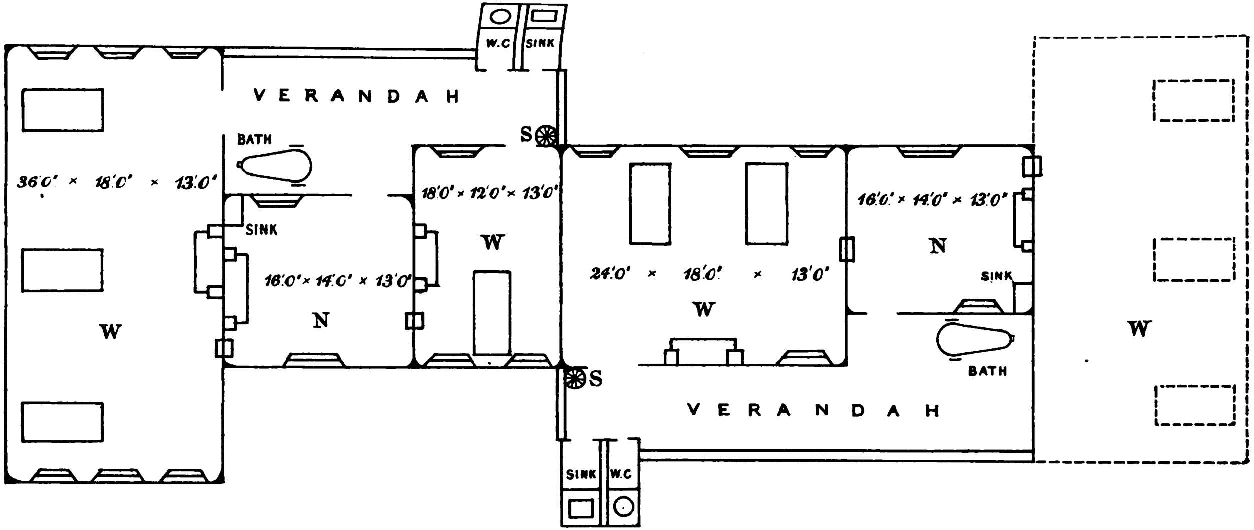
Ground Floor.

I. Isolation Doors. S. Spiral Staircase to first floor of the Sanatorium.

The first floor of the Administrative Building is as shown in Plate IV., Fig. 2.

The first floor portion of the Sanatorium is practically arranged the same as the ground floor.

Slightly altered from Plan C of Paget's "School Sanatoria."—

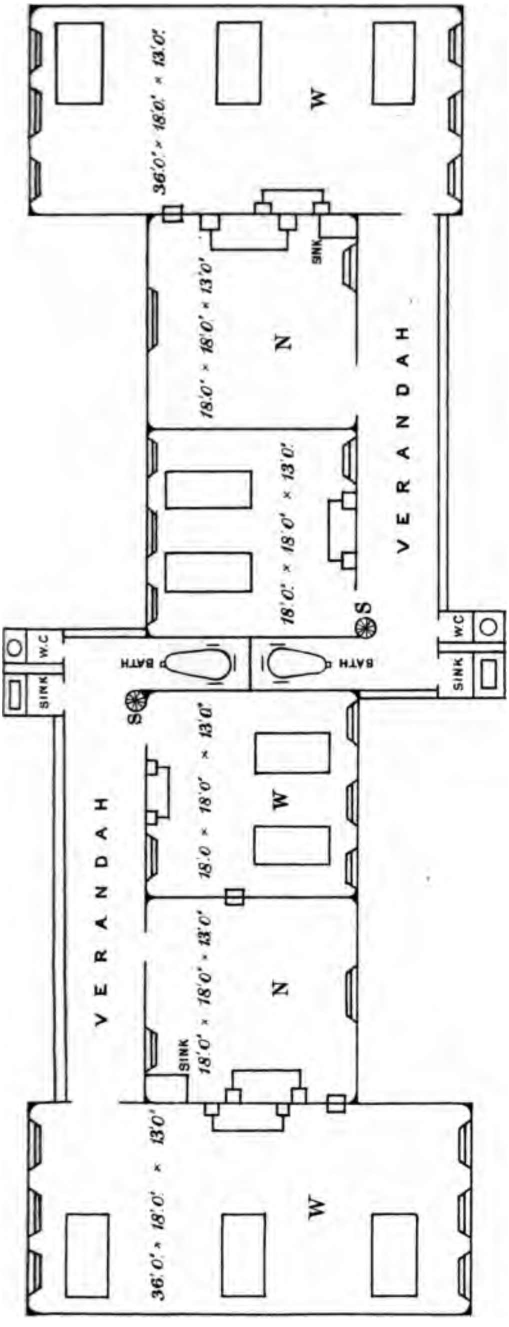


W. WARDS. N. NURSES' DAY-ROOMS. I. INSPECTION WINDOWS (FIXED).

S. SPIRAL STAIRCASES LEADING TO NURSES' BEDROOMS. FOR ADMINISTRATIVE BUILDING VIDE PLATE IV., FIGS. 7 & 8.

FIG. 10.

FROM PAGET'S "SCHOOL SANATORIA" PLAN A.



W. WARDS. N. NURSES' DAY-ROOMS. I. INSPECTION WINDOWS (FIXED).

S. SPIRAL STAIRCASES LEADING TO NURSES' BEDROOMS. FOR ADMINISTRATIVE BUILDING VIDE PLATE IV., FIGS. 7 & 8.

FIG. II.

FROM PAGET'S "SCHOOL SANATORIA." PLAN B.

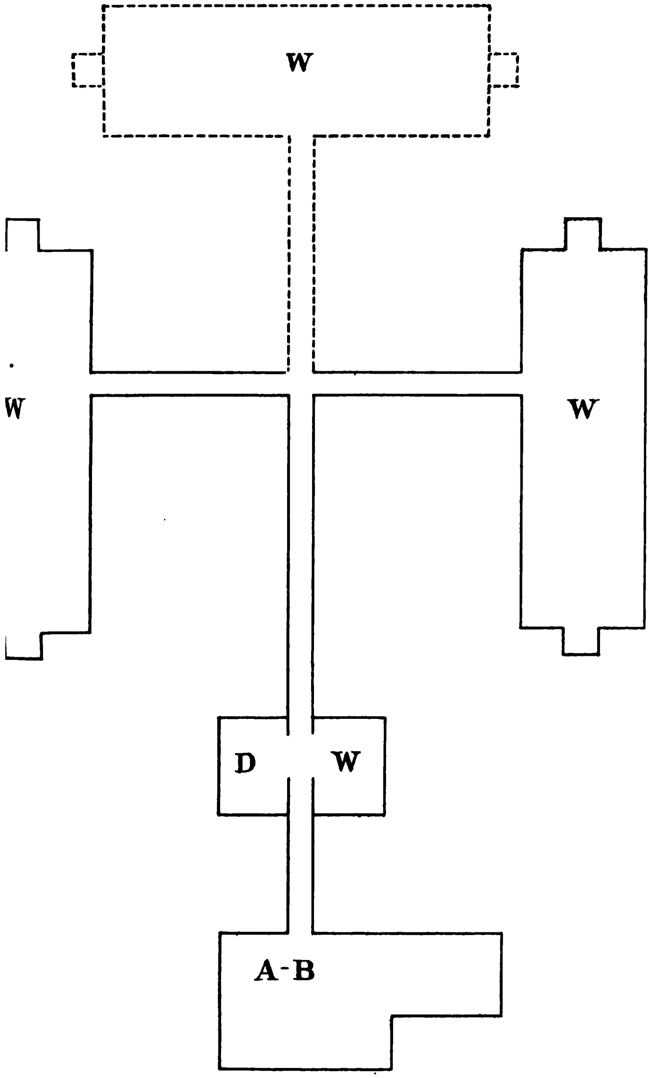


Fig. 12.

-B. Administrative Building, as in Plate IV.

W. Wards for Isolation of Doubtful Cases; or for Convalescents.

Ward Buildings, as in Fig. 1., Plate IX.

itly altered from Plan D, Paget's "School Sanatoria."

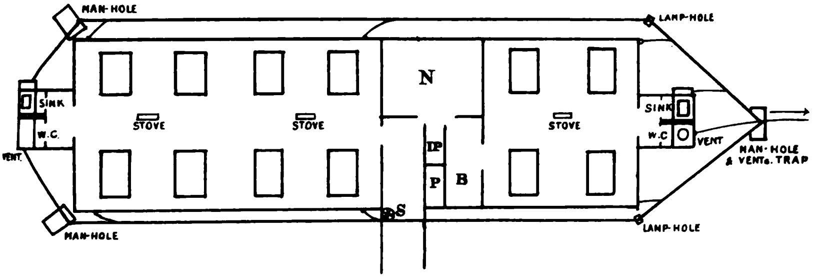


Fig. 13.

N. Nurses' Day-room.
L. P. Linen-press.
P. Ward Pantry.
B. Bath-room.
S. Spiral Staircase to Nurses' Bedroom.

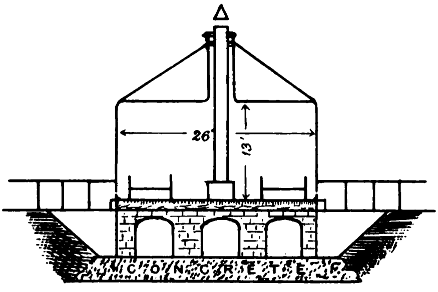


Fig. 14.

Transverse section of above Ward, showing arches built on a concrete bed, railed way over excavated ground, the curved corners of the Wards, and the arrangement for the passage of the stove chimney through a funnel in the roof for ventilation purposes. The joists of the Ward are laid in concrete on the top of the arches. From Paget's "School Sanatoria." Plan F.

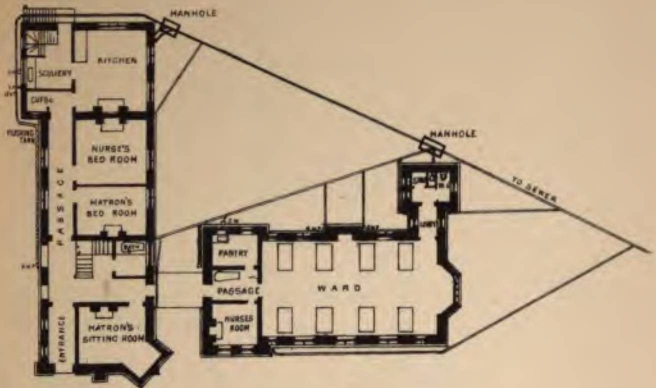


FIG. 15. GROUND FLOOR.

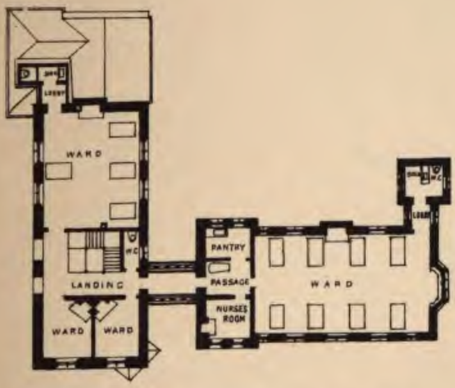


FIG. 16. FIRST FLOOR.

SMALL SANATORIUM WITH WARDS ON BOTH FLOORS.

AFTER PLANS BY KEITH D. YOUNG, ESQ., F.R.I.B.A.

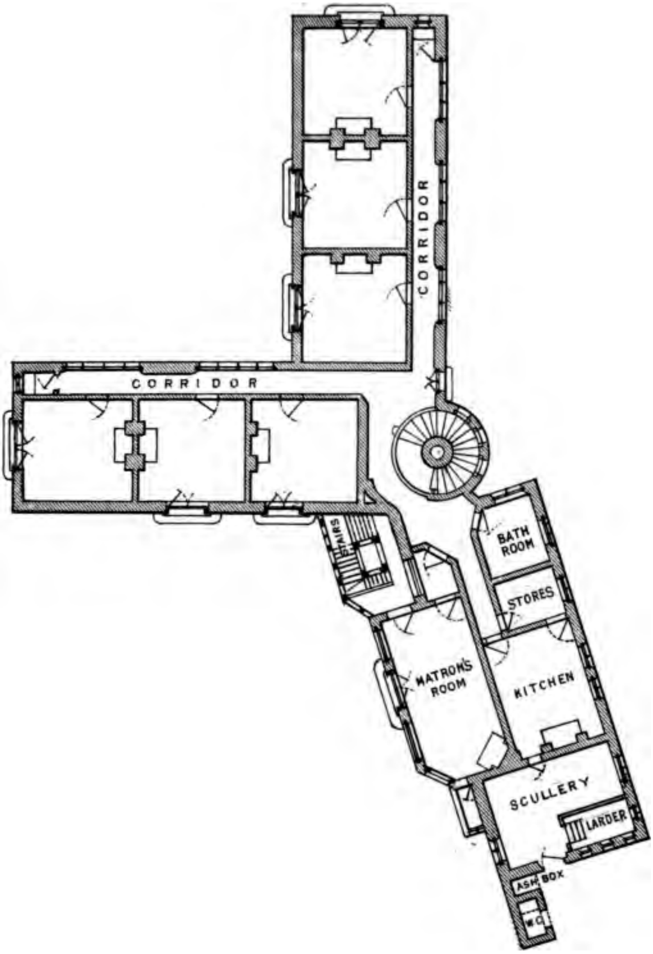


Fig. 17. **Ground Floor.**

Tri-radiate Sanatorium. After Plan by Dr. Clement Dukes.

Plate XI.